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163496 163496

SEARCH REQUEST FORM Scientific and Technical Information Center - EIC2

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Date 8/23/05 Serial # 09/874 026 Priority Application Date 06/06/0

Your Name Mark Consilvio Examiner # 80472

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I would like to find the original posting date.

One source for article is at: www.atmsite.org/contrib/Shaw/platform/

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Searcher: HARRISON

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Searcher Location: STIC-EIC2800, JEF-4B68

Date Searcher Picked Up: 9-6-05

Date Completed: 9-6-05

Searcher Prep/Rev Time: 40

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Type of Search

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STIC Search Report
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STIC Database Tracking Number: 163496

TO: Mark Consilvio
Location: JEF-3C21
Art Unit : 2872
Wednesday, September 07, 2005
Case Serial Number: 09/874,026

From: Jeff Harrison
Location: EIC 2800
JEF-4B68
Phone: 22511

Search Notes

Re Chuck Shaw paper, *Cylindrical Bearing Equatorial Platform*

I found the February 1999 html version at this URL:
http://web.archive.org/web/19990220074301/www.atmpage.com/platform.html

The above page is attached. Some of the embedded photos are missing, though.

That page above was found by hyperlinks on the page at this URL:
http://web.archive.org/web/19990202143359/http://www.ghgcorp.com/cshaw/platform.htm

There is also a February 1999 zipped version hyperlinked on that same
http://web.archive.org/web/19990202143359/http://www.ghgcorp.com/cshaw/platform.htm
page, but I am unable to open the zipped version on my workstation.

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If you would like more searching on this case, or if you have questions or comments, please let me know.

Respectfully,
Jeff Harrison

Jeff

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EIC 2800

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Jeff Harrison, EIC 2800 Team Leader
571-272-2511, JEF 4B68

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- *I am an examiner in Workgroup:* ☐ *Example: 2810*
- *Relevant prior art **found**, search results used as follows:*
  - ☐ 102 rejection
  - ☐ 103 rejection
  - ☐ Cited as being of interest.
  - ☐ Helped examiner better understand the invention.
  - ☐ Helped examiner better understand the state of the art in their technology.

  Types of relevant prior art found:
  - ☐ Foreign Patent(s)
  - ☐ Non-Patent Literature
    (journal articles, conference proceedings, new product announcements etc.)
- *Relevant prior art **not found:***
  - ☐ Results verified the lack of relevant prior art (helped determine patentability).
  - ☐ Results were not useful in determining patentability or understanding the invention.

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Cylindrical Bearing Equatorial Platforms
Cylindrical Bearing Equatorial Platforms. **Chuck Shaw** ... Alan Gee designed a **platform** that used a **cylindrical bearing** on one end and a single pivot on the ...
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Cylindrical Bearing Equitorial Platform
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Equatorial Platform - Reagan's Dob Tracker
My latest **equatorial** plarform (lower left) has a north **cylindrical bearing** ... This **equatorial platform** puts an axial **bearing** through the center of Warren ...
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New Page 0
A Ponchet styled Dual **Cylindrical Bearing Equatorial Platform** ... The design was taken from a similar circuit published at **Chuck Shaw's** webpage at ...
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Re: ATM Equatorial Platform
... shore.net; Subject: Re: ATM **Equatorial Platform**; From: cshaw ... To: cshaw@ghg.net (**Chuck Shaw**); Sender: owner ... The dual sector **cylindrical bearing** approach allows you ...
astro.umsystem.edu/atm/ARCHIVES/NOV98/msg00906.html - 5k - Supplemental Result - Cached - Similar pages

> Re: ATM Equatorial platforms
> ... The downside of the **cylindrical bearing** design is there are TWO ... of the **platform** to not cause the moving **platform** to be knocked off the tangent **bearings**. ...
> astro.umsystem.edu/atm/ARCHIVES/JAN01/msg01443.html - 9k - Supplemental Result - Cached - Similar pages
> [More results from astro.umsystem.edu]

Equatorial Platform Meeting Notes
For those unfamiliar with the term, an **equatorial platform** is a low ... The shaw **platform** uses **cylindrical** sectors for both the north and south **bearings**. ...
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... and http://www.atmpage.com/**platform**.html - An article by **Chuck Shaw** on the ... The South pad sits over a conventional **cylindrical bearing** section bolted ...
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[ATM] Equatorial platform
[ATM] **Equatorial platform**. **Chuck Shaw** cshaw at ghg.net ... What have other people done to connect > the roller to the '**cylindrical bearing**'? ...
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     FILE 'DPCI' ENTERED AT 16:41:16 ON 06 SEP 2005
L5              0 SEA ABB=ON  PLU=ON  (CHUCK OR SHAW)/REN AND CYLINDRICAL/REN
                  AND BEARING/REN
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                  /REN AND BEARING/REN
L7              0 SEA ABB=ON  PLU=ON  EQUITORIAL/REN AND PLATFORM/REN AND
                  CYLINDRICAL/REN AND BEARING/REN
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                  CYLINDRICAL/REN AND BEARING/REN
L9              0 SEA ABB=ON  PLU=ON  PLATFORM/REN AND CYLINDRICAL/REN AND
                  BEARING/REN
L10            31 SEA ABB=ON  PLU=ON  CYLINDRICAL/REN AND BEARING/REN
L11             0 SEA ABB=ON  PLU=ON  (CHUCK AND SHAW)/REN AND CYLINDRICAL/REN
                  AND BEARING/REN

     FILE 'SCISEARCH' ENTERED AT 16:42:48 ON 06 SEP 2005
                  E SHAW C, 1999/RE

     FILE 'STNGUIDE' ENTERED AT 16:43:29 ON 06 SEP 2005
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0 pages	0 pages	0 pages	3 pages	3 pages	4 pages	2 pages	0 pages	0 pages	0 pages
			Feb 02, 1999 *	Apr 15, 2000 *	Apr 13, 2001 *	Aug 03, 2002 *			
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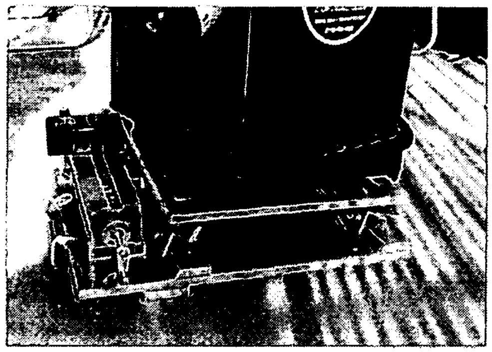
Cylindrical Bearing Equitorial Platform

Dobsonian Mounts (simple Alt Az Mounts) allow a newtonian to be very inexpensively mounted and quite easily used. However, the "Dob" mount does not track. Instead, you simply push it around while looking through the eyepiece. At low powers this is no problem. Even at high powers its no problem for one observer using the scope. However, at high magnifications when trying to share the scope, targets can quickly drift out of the FOV. This is where a tracking mount REALLY comes in handy. Star parties where you are trying to show off Saturn's rings are a CLASSIC example.

Combing the ease of re-aiming a Dob, with the ability for the scope, once re-aimed, to track what it is aimed at is where an equitorial platform comes into the picture. Imagine just picking up your Dob, and sitting it down on a low "box" about 5 inches high and roughly the same size in length and width as your present ground board. Then imagine that the top of the "box" moves to counteract the rotation of the earth. What you have is an equitorial platform!!!

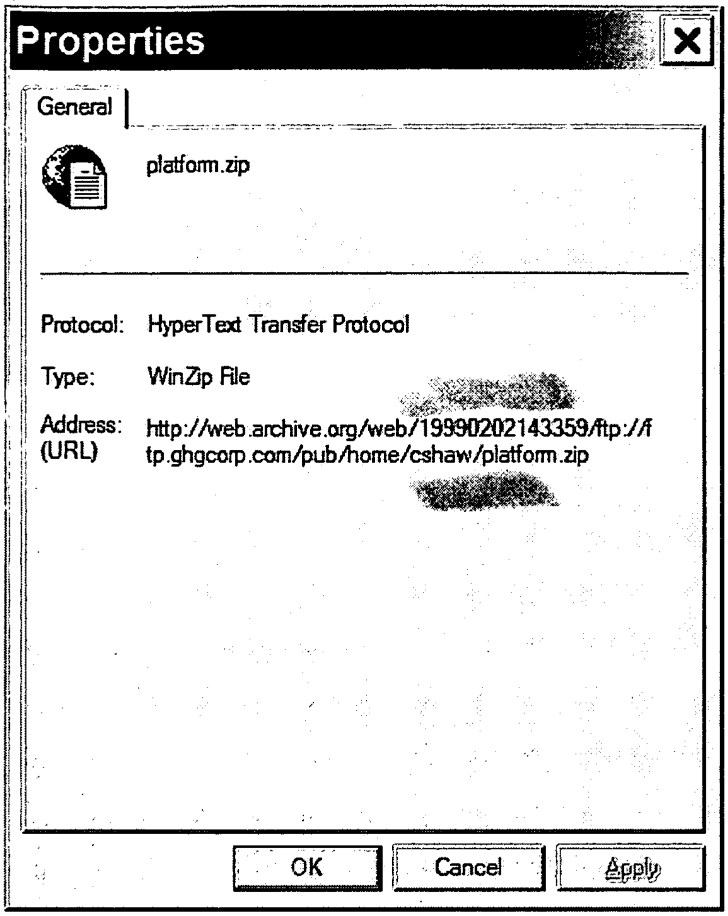


There have been several designs for equitorial platforms. All have their strong points and weak points. I tried to take the strong points and combine them into a design that was able to be fabricated by the average amateur telescope maker using average home builder tools (i.e. no special machine shop skills or tools necessary). Then I built one, and it was successful enough the Astronomy club I am in did a "group" build of them. To capture all of this, I wrote the results of this effort into an article. The article I wrote has been "html'ized" by the webmaster of the ATM Page (Matt Marulla) and can be viewed by clicking here. (Thanks Matt!!!) html

To download a .zip file of the complete article with some extra material Matt was not able to include, click here. ftp zip

One of the mystifying parts of building a platform is the initial design (sizes, etc. of the components). To address this, Jan Van Gastel, An Amateur Astronomer who lives in the Netherlands, and his son Joris collaborated on a simple program to do all the calculations for the sizes and layout of a platform of this design. Jan is a psychologist working as a curriculum manager at the Free University in Amsterdam and enjoys birding, amateur astronomy, and playing blues harmonica. Joris, his son, is a college student who like computer programming and guitar. In addition to writing software together, they both play in the same blues band! Quite a team it sounds like!!! To download a .zip file of Jan and Joris's program to calculate the sizes and gear ratios for the platform, click here.

Cylindrical Bearing Equatorial Platform from Chuck Shaw



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Cylindrical Bearing Equatorial Platform

Contributed by *Chuck Shaw*

Note: Many people have built platforms from these plans. Fred Quarnstrom and Bill Prewitt have both sent in photos, available in the Gallery section. The photos in this article (including the one above) are of Bill Prewitt's platform.

Introduction

A newtonian on a dobsonian mount sitting on an equatorial platform could be just about the best of all worlds for many observers. When you combine the larger aperture for the money that a newtonian provides, the ease of construction and use of dob type alt/az mount, and the ability to have whatever you aim the scope at **stay** in view for almost an hour at a time, that's a tough combination to beat! Even photography is possible using an equatorial platform if polar aligned properly and performed reasonably close to the meridian.

The earliest designs for an equatorial platform I could find published in magazines were by Adrien Poncet (*Sky & Telescope*, January 1977, pg 64). Poncet's design uses a pivot point and rollers/slides on a plane to define the motion of the platform. Alan Gee designed a platform that used a cylindrical bearing on one end and a single pivot on the other. Georges d'Autume improved these designs by eliminating the single pivot and introduced the concept of using a conical bearing to reduce the high loading on the Poncet based designs (a potential problem for larger scopes, but not smaller ones). Messieur d'Autume provided an excellent review of all these designs back in 1988 (*Sky & Telescope*, September, 1988, pg 303). I have seen and used platforms based on this conical bearing design that were made by Andy Saulietis. I also got an ear full from Andy on the difficulty of machining conical bearings! There had to be a better way! That's when I decided to try using all cylindrical bearings, similar to what Alan Gee did on the north end of his design. Before I go on however, it might be wise to make sure everyone understands the concept of how a platform really works.

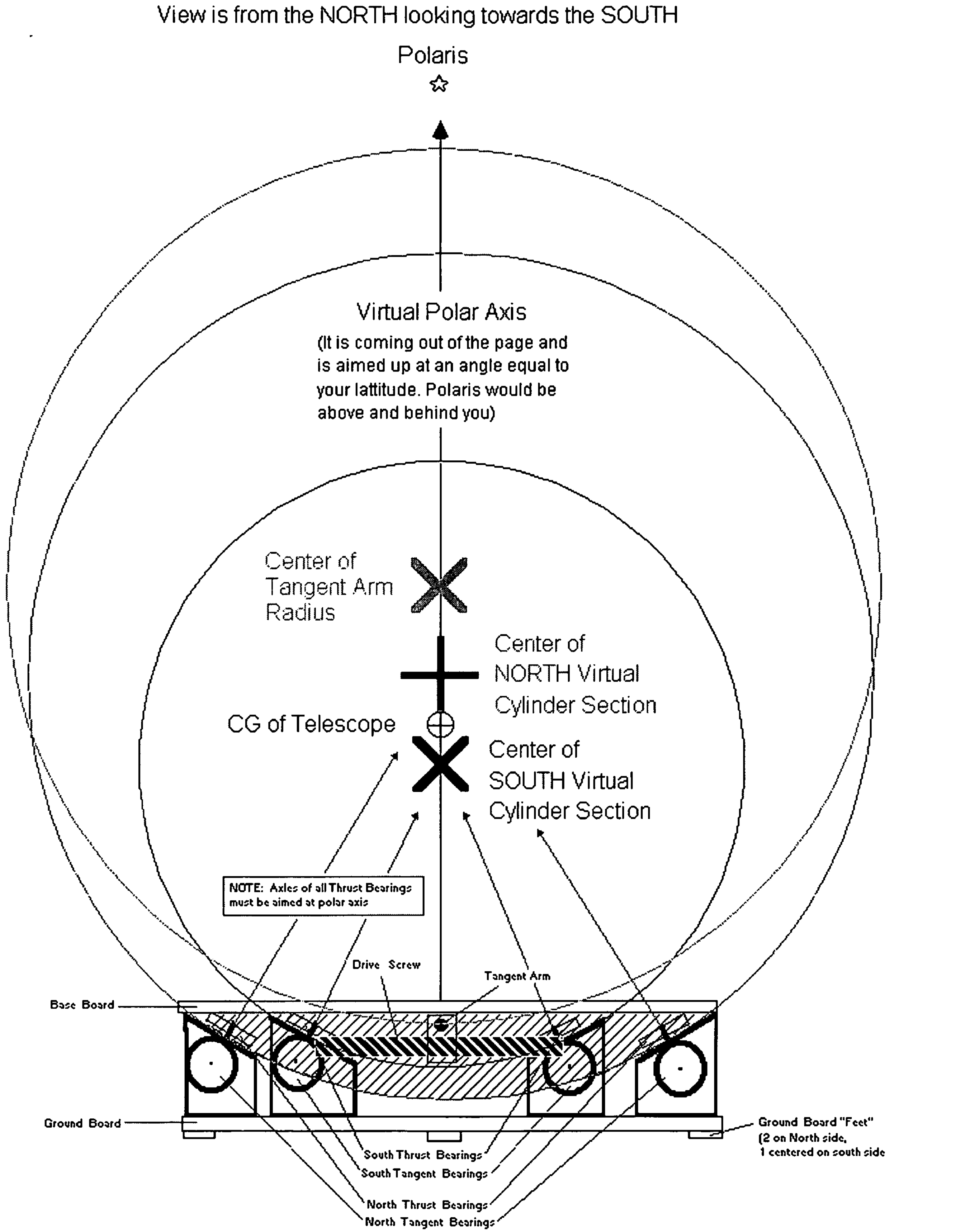
Basic Concepts

The best way to start is to think of a Ferris wheel. Each basket hanging from the wheel's rim stays in the same orientation as the wheel turns. They do this because each basket is able to turn on a bearing or axle that is parallel with the Ferris wheel's main axle. Each basket turns at the same rate, but in the opposite direction, on their axles as the main Ferris wheel does on its axle.

OK, so now take that image in your mind and picture the earth turning on its axis. If you had a basket on the equator, hanging from an axle parallel to the earth's axis (which at the equator would also be parallel with the earth's surface), and turned it opposite to the direction the earth is turning, it would appear to rotate once each sidereal day. It would also be staying perfectly still with respect to the stars (for all practical purposes). So, if you set your telescope on this basket whatever you were aimed at would stay in view, at least till the basket rotated enough to cause the scope to fall over! Before that happens though, you would need to swing the basket back through vertical and maybe a bit to the other side and re-aim the scope

As you move away from the equator, the axle for your basket has to still be parallel to the earth's axis of rotation, but this forces it to no longer be parallel to the ground. In fact, it will be at the same angle as your latitude. Remember, it is approximately aimed at Polaris, just as the earth's axis is. For this reason, we will refer to this axle as the *Polar Axis*. However, if you still just sit your scope on the basket, it will probably not only try to fall over from rotating, but it will be tilted north/south too! This is where an equatorial platform design comes into play!

So, when you are not at the equator, the idea is to make each arm that the basket (or platform) hangs from a different length, so the basket itself stays level. That would work, but the arms and the axle (Polar axis) would be in the way of using the telescope. So, think of the arc that the ends of the basket's arms scribe. Now think of having a cylindrical disk that is the same diameter of that arc, and with its center on the polar axis. Obviously, the disk that would be on the north side will be larger in diameter that the one on the south side (in the northern hemisphere anyway). If you rest these two disks on bearings, and then connect them with a flat platform that is parallel to the earth's surface, and then remove everything **above** that platform, what is left is an equatorial platform! It will be able to turn on a *virtual* polar axis. The north/south tilt problem will be eliminated, but the rotation problem will still exist. However, if you limit how much rotation you allow, it never becomes much of a problem. Most designs limit the rotation to approximately 7.5 degrees on either side of vertical. This allows a total of 15 degrees, which provides approximately one hour of tracking. Pretty clever huh?



If you draw the virtual polar axis through the center of gravity of your scope, and then play with the spacing of the two virtual cylinders a bit to keep the size of the platform connecting them the same size as the normal baseboard size of your dob mount, the effort to rotate the entire platform and scope is minimized, which means you only need a very small motor to drive the whole thing.

There are a number of ways to drive the platform. The simplest concept is just to turn one of the bearings into a roller that is connected to a motor. While simple in concept, this option is slightly more complicated to build. You have to think of materials for the roller (to avoid/minimize slippage), and you need a clutch to disengage the drive motor to roll the platform back to its beginning of travel. Balance is also more critical since friction is the only thing keeping the roller from slipping.

Slightly less sophisticated, but easier to build and more forgiving of errors in balance is a tangent arm drive. This option has a drive screw that has a nut on it, which grabs a tangent arm attached to the platform. The linear motion of the nut along the drive screw is turned into rotational motion, The nut has a tang attached to it that grabs the tangent arm. This tang has a vertical slot to allow for the motion of the tangent arm. This design is only really accurate near the mid-travel point of the platform when the drive screw nut is actually tangent to the arc the tangent arm describes. In addition, all the extra pieces each introduce a bit of slop into the drive system, which also hurts tracking accuracy. However, for visual work, including using high power, the accuracy is more than adequate. Another way to attach the drive screw to the tangent arm is by a wire/chain that is bent around a sector instead of just a single tangent arm pin. This results in a dramatic increase in accuracy at very little additional complexity. It's problem is that you can no longer just lift the upper platform off of the lower platform since they are connected by the wire/chain. Both of these options also require a clutch between the motor and the drive screw. However, using plastic gears like in radio control cars, and pivoting the motor to disengage them, provides a simple, cheap clutch option.

I suggest first building the tangent arm drive. Its simple and its accuracy is more than enough for even very high power visual work when the platform is polar aligned and running at the right speed.

Speaking of speed, there are also a number of options on how to drive a platform. I am a big fan of having everything battery powered so I do not have to stay near a 110V outlet (or need an inverter, etc.). However, if you do not mind these things, AC synchronous motors will solve the problem easily for you (more later on how to decide what speed). If you favor battery operations as I do, then you must decide on either a DC stepper motor or a regular DC motor. A stepper motor is very accurate. It only moves a measured amount each time its windings are energized. Then the next set of windings are energized and it moves again, and so on. Reasonably simple circuits have been described in many articles to drive stepper motors and this is really the right way to do it. However, remember the steps have to be fairly small and fast in order to not be seen when using the scope visually. This is more important for the driven roller option than the tangent arm option. This constraint, in turn, suggests gearing down the stepper motor to allow it to turn faster. I suggest at least 4 rpm or faster for a stepper motor to keep the vibrations from the steps from being objectionable. Circuit designs that half step (make the size of the steps smaller) also really help the smoothness and precision.

There is a simpler option that sacrifices a bit of accuracy, but is still more than adequate for high power visual work. Simply run the platform off of a simple DC motor. You vary the voltage to vary the speed of the motor. As the battery wears down, you increase the voltage (a simple potentiometer in series with the motor) to speed it back up. There is a

very simple DC to DC converter circuit based on a Radio Shack variable voltage regulator that you can use to automatically maintain the DC output voltage constant. This is actually accurate enough for some photography! Due to the simplicity and less cost of using a DC motor, I suggest you start with this option and later experiment with adding the DC to DC converter. Then you can upgrade later to a stepper motor if you feel you need it.

All this theory is all well and good, but how do you bring this to life? Well the rest of this article will try to lead you through the different steps in building a platform.

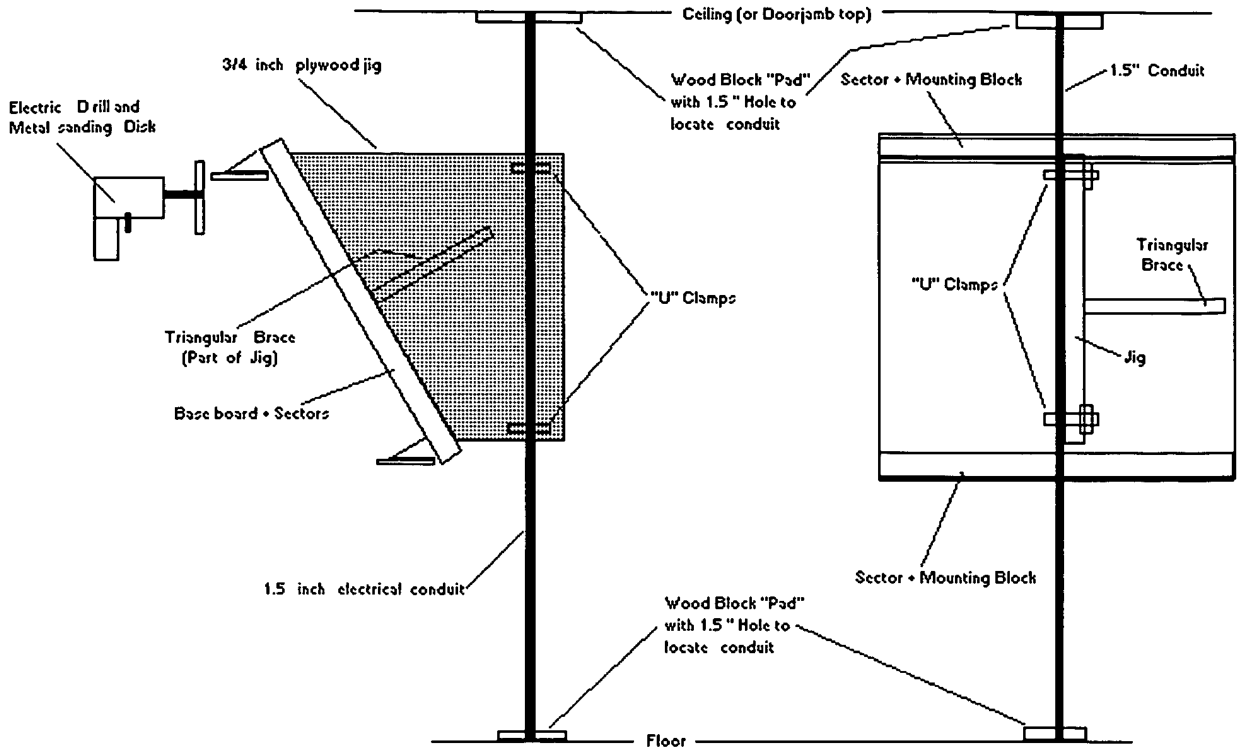
Construction

The first step is to measure the height of the center of gravity of your scope. The dimension is from the center of the altitude bearings to the top of the ground board. If you intend to just sit the entire scope and dob mount on top of the platform, measure the height from the center of the altitude bearings all the way to the ground. Also measure the size of the ground board. This will determine the spacing between the cylindrical bearing sectors. You also need to determine the latitude that the platform will be primarily used at. If you go north or south of that latitude it will still work, but will need to be shimmed to keep the virtual polar axis aligned. 10° of shimming will cause no problems. A good suggestion is to round off the latitude to make cutting the pieces a bit easier. While not required, it may make setting up table saws, etc. a bit easier. The polar alignment procedure will insure the platform has it's polar axis aimed correctly.

Lay this out in a scale drawing, similar to the figure above. Be reasonably careful, but perfectly exact dimensions are not really required at this stage. For your drawing, assume the base board is 3/4 inch plywood, and the sectors extend 2 to 2.5 inches below the bottom of the plywood. Now you can measure the radius of both the north sector and the south sector from your drawing.

The sectors themselves, whether wood or aluminum, will be attached to two triangular cross section blocks. The cross section shape will need to match the latitude the platform is being built for. You need to scribe the arc that the sectors have on the blank pieces. For wooden sectors, a router with a jig to have it cut the arc works well. For metal, scribe the arc and cut it out with a bandsaw.

Attach the sectors to the support blocks, and then to the base board. If the sectors are metal, they will need to be trued. In order to do this, you need to build a jig to hold the base board like this:



The 1.5" conduit is along the virtual polar axis. Make the 3/4" thick plywood jig of a size to hold the conduit the right distance from the base board. Attach the conduit to the jig with U clamps. Cut the conduit to a length such that it can be tightly wedged into a door jamb or garage door opening. Keep it from wandering around with two wood blocks with 1.5" holes in them tacked to the door jam and floor. The jig needs to keep the base board square, so add at least one triangular brace between the jig and the baseboard. All this sounds complicated, but its really simple. If more than one platform is being made, it is shared work too, since the jig is reusable (just make sure the CENTER of the conduit is along the Polar axis. The jig will have to be offset from center to make the conduit ride along the center (This is **important!**)

The electric drill should be held in place securely. Use something like a Work Mate to clamp the drill. Rotate the Baseboard/Jig back and forth while just touching the sanding disk. Do not try to take too big a bite with the metal sanding disk since it will deflect and you will end up with a surface that is not square. If this does happen, the platform will still work just fine, the bearings will just not ride on as much surface of the sector. Go slow and enjoy watching the fine finish appear and observe the motion of the platform around the polar axis (conduit). You will be amazed at the precision grinding that will be the result even using such a crude setup!! This is a bit more work than just cutting them out of wood with a router. I think the increased durability is worth the extra effort, but you be the judge. Both options work well as long as the sectors are smooth.

With the upper portion of the platform completed, start work on the ground board. The bearings can be mounted using wooden blocks or angle aluminum. I use 2" aluminum angle. You will have to whittle on the shape to get the tangent bearings to be in the same plane as the sectors, and then do a bit more whittling to get the axles of the thrust bearings to cant inward towards the polar axis. Go slow and compare often and the job is easy. If you are using wooden sectors, try using the concave scrap leftover as a mount for the the rollers. It already has the approximate shape you will need to align the rollers, just cut the bottom off at the same angle as your latitude.

When all 4 bearing holders are ready to be mounted, place the north bearings in place (they will be wider apart since that sector has a slightly larger diameter). Then place the south bearings in place. Move the bearings in/out till you have the same amount of rotation in each direction. You will have to play with the exact location of the bearing assemblies to make sure that all 8 bearings stay in contact with their respective sectors at all times. Again, it sounds harder than it is. The secret again is to go slow and be patient.

The center of gravity of the telescope should be on or just below the virtual polar axis. This will minimize the effort to rotate the platform and telescope about the polar axis. The CG of the scope is at the intersection of the altitude axis (that connects the centers of the altitude bearings) and the optical axis (down the center of the tube). The two imaginary cylinder sections that rotate about the polar axis rest on the roller bearings. The aluminum plates that actually do touch the bearings are a portion of those imaginary cylinder sections. The tangent bearings are in the same plane as the cylinder sections. The thrust bearings are perpendicular to the plane of the cylinder section and, **very importantly**, the thrust bearing axles are canted inward so that they aim at the polar axis. This is neccesary for the bearings to remain in contact with the aluminum sector plates through the entire rotation.

The sectors may be fabricated out of hardwood (such as maple) instead of metal. In this case, hard plastic wheels such as skateboard wheels should be used in place of steel roller bearings. Even small dents in the sectors will show up in the eyepiece.

The ground board has 3 feet. Two are on the north side, the 3rd is centered on the south side. Three feet assure that the platform will not rock. When setting the platform up and polar aligning, it will be important to level the platform in N/S tilt, but not so important in E/W Tilt (since the platform rotates in that direction). More about this later. Putting adjustable feet on using T-nuts and 3/8 carriage bolts is a good idea and can be added if desired. Put a wooden disk on the end of the carriage bolt as a foot so it won't sink into the ground.

The tangent arm is next. A 1/4" lag bolt with its head cut off will do nicely. Either measure off of your drawing or use the grinding jig to measure what the radius the tangent arm describes. Then calculate the circumference of the circle the tangent arm makes. As an approximation, use 24 hours for the rotation rate for the platform. You can then divide the

circumference of the tangent arm's circle (in inches) by 1440 to get inches per minute that the tangent arm must travel. I use 16 tpi threaded rod as a drive screw. That means the rod must turn 16 times to move the tangent arm 1 inch. So, multiply the required speed of the tangent arm in inches per minute, by the number of threads per inch, to get how fast the threaded rod must rotate per minute. For average sized telescopes it will be somewhere about 2 rpm.

Hold the threaded rod between two bearings as in the above figure. Attach the bearings to the rod with nuts jammed against the bearings. A small wooden box that has holes drilled in the ends the same size as the bearing outer races makes a nice drive box. Extra pieces of aluminum angle can also be used to hold the end pieces in place. Use large fender washers on the inside of the drive box to keep the threaded rod and bearings in place and react the pushing on the platform the drive screw must perform. The length of the travel of the drive screw must be adequate to swing the platform through 15 degrees (i.e. 1 hr of travel). Use gears found at hobby shops for electric cars to couple the drive screw to the motor. Two nuts on either side of the gear on the drive screw will hold it in place. Mount the motor on a hinge to be able to swing it into mesh with the gear on the drive screw, and to swing it out of the way to disengage it during rewind. Hold it in mesh with a small spring.

The nut that travels along the drive screw should be a coupling for the all thread. Attach a flat plate (tang) to the coupling with two U clamps. Make the plate long enough to reach down between two runners. The slot will keep the tang (and coupling) from turning with the drive screw. Cut a slot in the plate for the tangent arm to fit through. Don't make the slot too big, the slop will show up in the eyepiece! However, the thicker the plate material, the looser the slot must be since the tangent arm will be at a slight angle at the ends of the travel and will bind. A strong spring attached between the tangent arm and the plate to always hold the tangent arm against one side of the slot will eliminate the play. You need a slot instead of just a hole since the tangent arm describes an arc that has it lower at mid travel than at the ends of travel. If the coupling is too loose on the threaded rod, there are at least two solutions. One is to pack the threads in the coupling with a mixture of talcum powder and epoxy, and coat the drive screw with PAM, or silicone spray (WD-40 is **not** good enough). Then slowly screw the drive screw into the coupling and let the epoxy harden. The talc/epoxy mixture will have made snug fitting threads for you and the lubricant will not allow the epoxy to bond to the drive screw. An alternative is to drill and tap two small (4-40) holes into the coupling at each end. Insert a nylon machine screw into the holes and gently tighten the nylon screws to eliminate any play. Both methods work wonders in eliminating play which will find its way into the eyepiece view.

So lets review what we have completed so far. The ground board should be completed by now with the 4 sets of two bearings each mounted and aligned. The drive screw box and motor can be mounted (make sure the box is not too close to the platform else the platform corners will hit at the end of the travel). The base board should have the two sectors mounted on their mounting blocks and the tangent arm (a 1/4" lag screw with the head cut off) attached. When the baseboard is set on the ground board and the tangent arm is inserted through the slot in the drive screw tang, attach a strong spring to hold the tangent arm over against one side of the slot to remove any play in the assembly. Very gently tighten the two 4-40 nylon machine screws in the coupling nut to take out play in the threads but not so tight as to add too much friction.

You can use the baseboard as the ground board for your dob mount, or you can simply set the whole thing on top of the platform. If you use the platform for the ground board for the dob mount instead of just sitting the scope on the platform, you may want to put a couple of long 1/4" x 20 bolts and T-nuts between the base board and ground board on the east and west sides to hold them together when you transport the whole thing. Don't forget to remove them before trying to run the platform though or it will stall!

The motor controller can be as simple as a battery and a pot hooked in series with a DC motor. In fact, I carry a spare emergency controller in my parts box made of these components and have loaned it to friends that have had problems in the field. So, start with something like that to get running as soon as possible. When you are ready, build a DC to DC converter. All parts can be purchased at Radio Shack. Hold all the parts in place with a small piece of perforated circuit board and put it all into one of the small experiment boxes (also found at Radio Shack).

Using the Platform

To use the platform is simplicity itself. Align the virtual polar axis with the earth's polar axis and turn it on. Adjust the motor speed to eliminate any RA rate error and enjoy! Whoa you say, how do you align the two virtual axes of the earth and the platform? Well, that's not so hard as you might think. Initially you want to spend some time doing it, and then you need to add two more small pieces of hardware. One is a level (the round ones are the best, ACE hardware carries them for about $2.00). The 2nd think is a small cheap compass. Once you get the platform initially aligned, glue the level to the ground board (the south side is best I think). This will make sure the polar axis is aligned in N/S tilt, as well as E/W tilt (even though E/W tilt is less important). It is important to note that when properly aligned, the base board will be level only at the center position. The ground board may never be level, depending on the spacing, etc. of the bearing assemblies. So, when attaching the level, you may have to shim it. The compass will allow you to repeat the E/W azimuth alignment. Using the compass and level will get you close enough for almost all visual work, and allow you to do it in 30 seconds. Be careful the compass is not too close to any metal parts! If closer alignment is desired, it will also get you to a very close staring point. Remember though, if you move to a different location, the compass and level may not be accurate for that location. As an aside, I also use the Telrad on my scope. I have pins on the alt and az bearings that lock the scope's optical axis with the platform's virtual polar axis. Then I just move the whole thing around till the pole is in the right place in the Telrad reticle. (This is only accurate if the platform has replaced the Dob's ground board).

The best way I have found to achieve a really accurate alignment, whether an equitorial platform or any other type of tracking mount is the two star drift alignment. I'll give you a quick description. Its a **lot** easier to do than to describe, but once achieved, thats why you want to attach the level and compass (or lock the alt and az bearings) to achieve a coarse alignment, which will be plenty accurate enough for most casual visual observing.

Initially, set the platform down and place a level on top of the base board (or inside the dob mount's box if the platform has replaced the dob mount's ground board) with the platform at mid travel and level the base board (not necessarily the ground board) in both directions. Also roughly aim the platform along north/south, with the motor/tangent arm towards the north. Now look in your star charts for a star on or close to the celestial equator (declination = 0) that is near the eastern horizon, and aim you scope at it. Use as high a power as you have. Don't worry about a good image, you will probably be doing this before the optics have finished cooling anyway and will only get a swimming blob. All you want is to be able to watch which direction it will drift. Now turn on the drive. If you have calculated the drive motor's rotation rate based on the geometry of your platform, adjust the motor to run at that speed. Now watch the star and see which direction it drifts. Use the pot in your motor control circuit to null the drift errors due to motor speed (RA errors). What is left is drift that is in declination (i.e. north/south). If the star drifts to the north (if in doubt, nudge the scope towards polaris, stars will enter from the north in the eyepiece field of view), that tells you the south end of the platform is too low (the virtual axis is aimed above polaris). If the star drifts to the south, then the south end of the platform is too high. Re-shim the platform and repeat the test again. Then find a star near the meridian, but also on the celestial equator. Again, watch which way it drifts in declination while you adjust the motor's speed, if required, to keep it in the center of the RA direction. If you are confused as to which direction is RA and which is Dec, turn off the motor and watch which direction the star goes. That is RA. Declination is perpendicular to that. If the star drifts to the north, then the virtual axis is pointing west of north. If it drifts to the south, the polar axis is aimed too far to the east. Rotate the platform to correct the error and re-perform the test. To make sure, recheck the star in the east, and then the one on the meridian again. When you have it, remember to attach the level and the compass. Any errors from then on are due to the motor running too fast or too slow. The DC to DC converter will automatically adjust the voltage for you as the battery slowly drains (at least till the battery gets to about 1.5VDC above what the motor needs, then it cannot help any more). Most DC motors I have used draw about 30-50mA and are 12V motors that I am running at about 3VDC. I use 6VDC gel cells from a surplus store (rechargeable), or a normal lantern battery. A lantern battery lasted an entire week at the Texas Star Party!

If you want to do photography, you will need to stay within 10-15 degrees of the meridian to avoid field rotation if you make declination corrections. For unguided photography, the motion is fine and has no rotation problems anywhere in the sky. But unguided shots require very good alignment and a carefully adjusted motor speed. Piggyback photography is much less demanding and is a lot of fun! You might try that at first. Another method of photography that is fun with a platform is video. I made a mount for my 8mm camcorder to look into a 32mm erfle (2"). Set the camcorder focus at infinity. I got some great shots of Jupiter and the Comet impact sites using this method! I also recently purchased an inexpensive survelience camera that has a removeable C-Mount lens. I can use this camera at "prime focus". Without the lenses in the optical path, and with the camera's increased low light level sensitivity, even some deep sky objects are video targets now.

Enjoy!

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